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properly. In such situations, it may be necessary for a new impression of the patient's jaw to be taken and for the appliance to be modified or replaced, which can be expensive and counter-productive in terms of achieving the desired effect for which the appliance is being used. Clasps such as Adams' clasps are also prone to breakage, particularly in situations where the appliance is difficult to install, and are also commonly incompatible for use with child patients who may not have sufficiently erupted teeth for the clasps to locate properly.

Examples of the present invention seek to overcome or at least alleviate the above disadvantages of conventional removable dental appliances.

### **Summary of the Invention**

In accordance with one aspect of the present invention, there is provided a removable dental appliance having a base adapted for locating inside of an arch of teeth of a wearer and an arch wire coupled to the base, wherein an outer surface of the base is contoured for contact with inner surfaces of the teeth, when in use the arch wire extends around an outer periphery of a set of the wearer's teeth such that no interconnection between the arch wire and the base exists intermediate the set of teeth, and the dental appliance is provided with one or more expansion screws for expanding the base.

In accordance with another aspect of the present invention, there is provided a removable dental appliance having a base adapted for locating inside of an arch of teeth of a wearer and an arch wire coupled to the base, wherein an outer surface of the base is contoured for contact with inner surfaces of the teeth, and wherein when in use the arch wire extends around an outer periphery of a set of the wearer's teeth such that no interconnection between the arch wire and the base exists intermediate the set of teeth.

Preferably, the arch wire extends from one side posterior portion of the base to the other side posterior portion of the base for contact with outer surfaces of the set of teeth along an outside of the arch.

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Preferably, the arch wire extends rearwardly relative to the posterior portions on each side of the base so as to allow limited movement of the arch wire relative to the base when the dental appliance is in use.

Preferably, the dental appliance is for an upper jaw of the wearer.

Preferably, when the dental appliance is in use, the arch wire extends continuously from a left side posterior portion of the base, outwardly behind a posterior tooth on the left side of the arch, forwardly along the outside left side of the arch, rightward along the outside front side of the arch, rearwardly along the outside right side of the arch, and inwardly behind a posterior tooth on the right side of the arch to a right side posterior portion of the base.

Preferably, the arch wire incorporates a plurality of U-loops. In one example, the arch wire incorporates four U-loops.

Preferably, the arch wire is provided with one or more C-clasps. More preferably, at least one of the C-clasps is coupled to the arch wire at only one end portion of the C-clasp.

Preferably, the arch wire is provided with one or more L-rests.

Preferably, the base is acrylic. Preferably, the base is provided with a bite plane. In one example the bite plane is an anterior bite plane. In an alternative example the bite plane is a posterior bite plane.

In accordance with another aspect of the present invention, there is provided a removable dental appliance having a base adapted for locating inside of an arch of teeth of a wearer and an arch wire coupled to the base, wherein an outer surface of the base is contoured for contact with inner surfaces of a set of teeth on one side of the wearer's jaw, when in use the arch wire extends around an outer periphery of the set of teeth such that no interconnection between the arch wire and the base exists intermediate the set of teeth, and the dental appliance has anterior wires or springs for urging forward anterior teeth of the wearer.

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In accordance with another aspect of the invention, there is provided a removable dental appliance having a base adapted for locating inside of an arch of teeth of a wearer and an arch wire coupled to the base, wherein an outer surface of the base is contoured for contact with inner surfaces of a set of teeth on one side of the wearer's jaw, and wherein when in use the arch wire extends around an outer periphery of the set of teeth such that no interconnection between the arch wire and the base exists intermediate the set of teeth.

Preferably, the arch wire extends continuously from a posterior portion of the base, outwardly behind a posterior tooth of said set of teeth, forwardly in contact with outer surfaces of said set of teeth, and inwardly in front of a front tooth of said set of teeth to the base.

Preferably, the removable dental appliance is for a lower jaw of the wearer.

Preferably, the base has a first lingual portion and an opposed second lingual portion, the first and second lingual portions being held apart by a resilient member, the first lingual portion is contoured for contact with inner surfaces of a first set of teeth on one side of the wearer's jaw and the second lingual portion is contoured for contact with inner surfaces of a second set of teeth on an opposite side of the wearer's jaw, and when in use, a first arch wire extends continuously from a posterior portion of the first lingual portion, outwardly behind a posterior tooth of said first set of teeth, forwardly in contact with outer surfaces of said first set of teeth, and inwardly in front of a front tooth of said first set of teeth to the first lingual portion, and a second arch wire extends continuously from a posterior portion of the second lingual portion, outwardly behind a posterior tooth of said second set of teeth, forwardly in contact with outer surfaces of said second set of teeth, and inwardly in front of a front tooth of said second set of teeth to the second lingual portion.

Preferably, each of the first and second arch wires is provided with one or more C-clasps. More preferably, at least one of the C-clasps is coupled to the arch wire at only one end portion of the C-clasp.

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**Brief Description of the Drawings**

Preferred embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of an underside (ie. the surface which in situ faces away from tissue of the upper jaw) of a dental appliance for an upper jaw;

Figure 2 is a perspective view of an upper surface (ie. the surface which in situ faces the tissue of the upper jaw) of the dental appliance shown in Figure 1;

Figure 3 is a front perspective view of the dental appliance shown in Figures 1 and 2;

Figure 4 is a top view of a dental appliance for an upper jaw;

Figure 5 is a side perspective view of an underside of the dental appliance shown in

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extends continuously from a left side posterior portion 24 of the base 12, outwardly (see reference numeral 25) behind a posterior tooth 26 on the left side of the arch 16, forwardly (see reference numeral 28) along the outside left side of the arch 16, rightward (see reference numeral 30) along the outside front side of the arch 16, rearwardly (see reference numeral 32) along the outside right side of the arch 16, and inwardly (see reference numeral 34) behind a posterior tooth 36 on the right side of the arch 16 to a right side posterior portion 22 of the base 12. The arch wire 14 also incorporates four U-loops 38 which may be adjusted to tailor the effect provided by use of the dental appliance 10. Although in other examples more than or less than four U-loops may be formed in the arch wire 14, the applicant has determined that four U-loops provides the arch wire 14 with an appropriate degree of flexibility whilst keeping good retention properties.

As the arch wire 14 extends rearwardly relative to the posterior portions 22, 24, spacing is achieved between the arch wire 14 and the base 12 so as to allow improved freedom of movement between the arch wire 14 and the base 12 during use. This assists in preventing too tight a fit which can cause tight locking of the maxilla and undue stress to the wearer. By promoting muscle relaxation in the wearer, clenching and other muscular movements detrimental to jaw alignment are avoided or at least reduced, and breathing is enhanced through improvement of the airway.

The enhanced freedom of movement of the arch wire 14 relative to the base 12 also facilitates a "spring fit" of the appliance, where it is snapped into place in a wearer's mouth. Advantageously, additional flexibility in the fit of the appliance is achieved, and greater scope is provided for adjustment of the appliance.

The dental appliance 10 shown in Figures 1 to 3 is also provided with a 3-way expansion screw mechanism 40 which has three expansion screws 42, 44, 46 for enlarging the maxilla of the wearer in left, right and anterior directions. Each of the expansion screws 42, 44, 46 is provided with apertures for receiving a tool (not shown) which is used by an orthodontist or patient to adjust the effective size of the base 12 according to the shape desired in the wearer's maxilla. The base 12 is able to expand in response to adjustment of the expansion screws 42,

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44, 46 by virtue of breaks 47 formed in the base 12 which divide it into three separate panels 48, 50, 52. The effect provided by the expansion screws 42, 44, 46 in this arrangement is advantageous as the arch wire 14 is around the arch 16 and there is nothing grabbing or hurting the teeth 17 as is often the case with conventional previously proposed dental appliances. As such, the present arrangement provides benefits in influencing the nervous system and muscle function of the wearer.

The base 12 has an anterior bite plane 53 which may be formed so as to be either flat or sloped in order to bring the wearer's lower jaw forward when the lower jaw is occluding the bite plane 53 and to relax the wearer's chin and neck muscles. The acrylic base 12 is formed according to the shape desired to be given to the wearer's jaw. The anterior bite plane helps to put the wearer's teeth together so that there is no deep bite and the right amount of bottom teeth are showing. Over time, a deep bite is able to be corrected and clenching is able to be reduced

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The pressure should be gentle and slow, and the widening allows the teeth to be realigned with greater freedom. Such realignment can be directed by the arch wire and by auxiliary wires or springs either soldered to the arch wire or fixed into the acrylic. Slight lateral expansion of premolars and molars if done correctly allows the pressure on cranial sutures to free up allowing jaw restriction to ease to varying extents, thus having a beneficial effect on the nervous system.

The bigger the mouth opens the more the entire body relaxes.

Due to the way the acrylic is on the inside and the arch wire is on the outside, teeth can move in 6 directions to achieve harmony. That is forwards and backwards, side to side and up and down.

Use of appliances in accordance with examples of the invention can promote realignment of the wearer's jaws, particularly by encouraging forward movement of the lower jaw, as well as improved ability of the patient to close his/her mouth and to breathe through the nose.

#### Manufacture of the Appliance

In order to manufacture a dental appliance as described above for a patient, impressions of the patient's jaws are taken, and models of the jaws are made from these impressions. It is desirable for the impressions and models to have a high degree of accuracy such that the appliance can be manufactured to fit well and to work effectively.

The detail should go right back to, and include, the rearmost teeth. Lower impressions require as much of the lingual plate as possible. When impressions are taken using alginate, they must be poured before they dry out. Models can be poured up next day if kept wet. Rubber impressions also can be good. They give the option of several pours, including study models. A new type of alginate, cum rubber, may be a problem solver; it is lighter for posting to laboratories and also less work for the staff. When taking impressions, after selecting a suitable tray for supporting the impression material, the loaded impression should be first pressed in

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backwards. This will avoid gagging the patient, and also prevent forcing the material to the back of the throat. Staff should ensure a good mixture, which is not too runny.

Instructions to the Laboratory

a) There are two basic designs of appliance and some variations. Usually the laboratory is